No. 818,801. PATENTED APR. 24, 1906.

K. VÖLLER.

AUTOMATIC BRAKE FOR TUBE RECOIL GUNS.

APPLICATION FILED APR. 7, 1904.

4 SHEETS—SHEET 1.

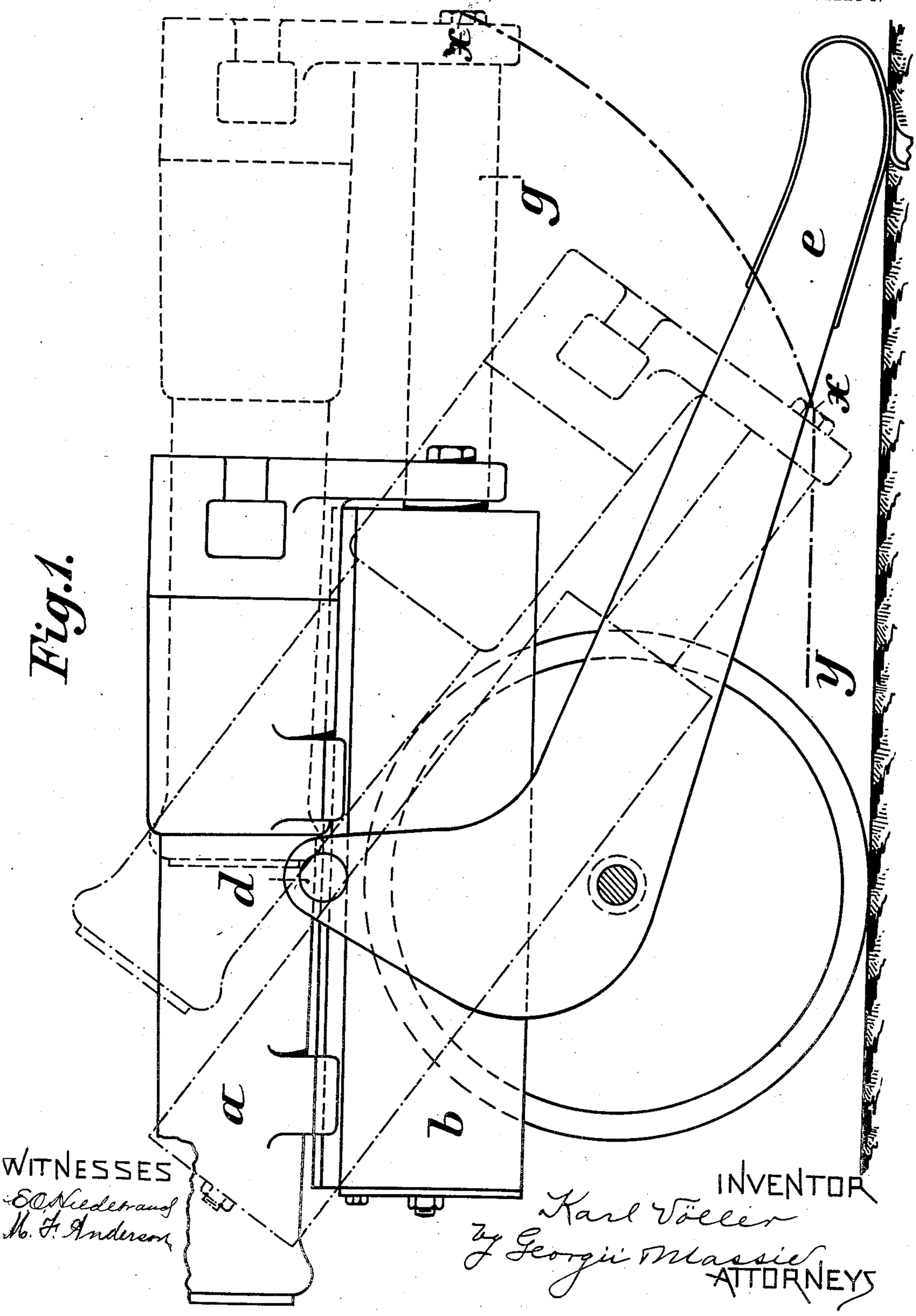


Fig. 1.

WITNESSES

E. O. Niederstrand

M. F. Anderson

INVENTOR

Karl Völler

by Georgii Massie

ATTORNEYS

No. 818,801. PATENTED APR. 24, 1906.

K. VÖLLER.

AUTOMATIC BRAKE FOR TUBE RECOIL GUNS.

APPLICATION FILED APR. 7, 1904.

4 SHEETS—SHEET 2.

Fig. 3.

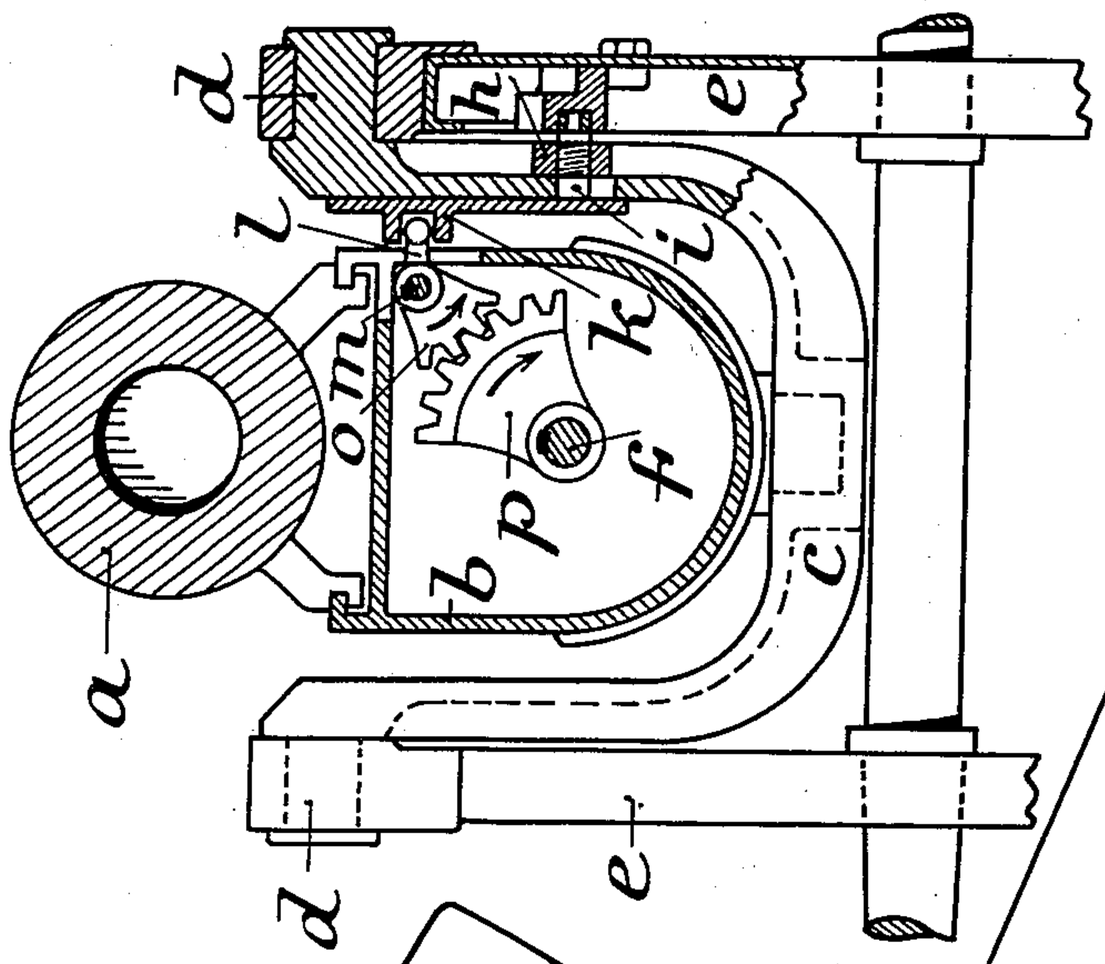
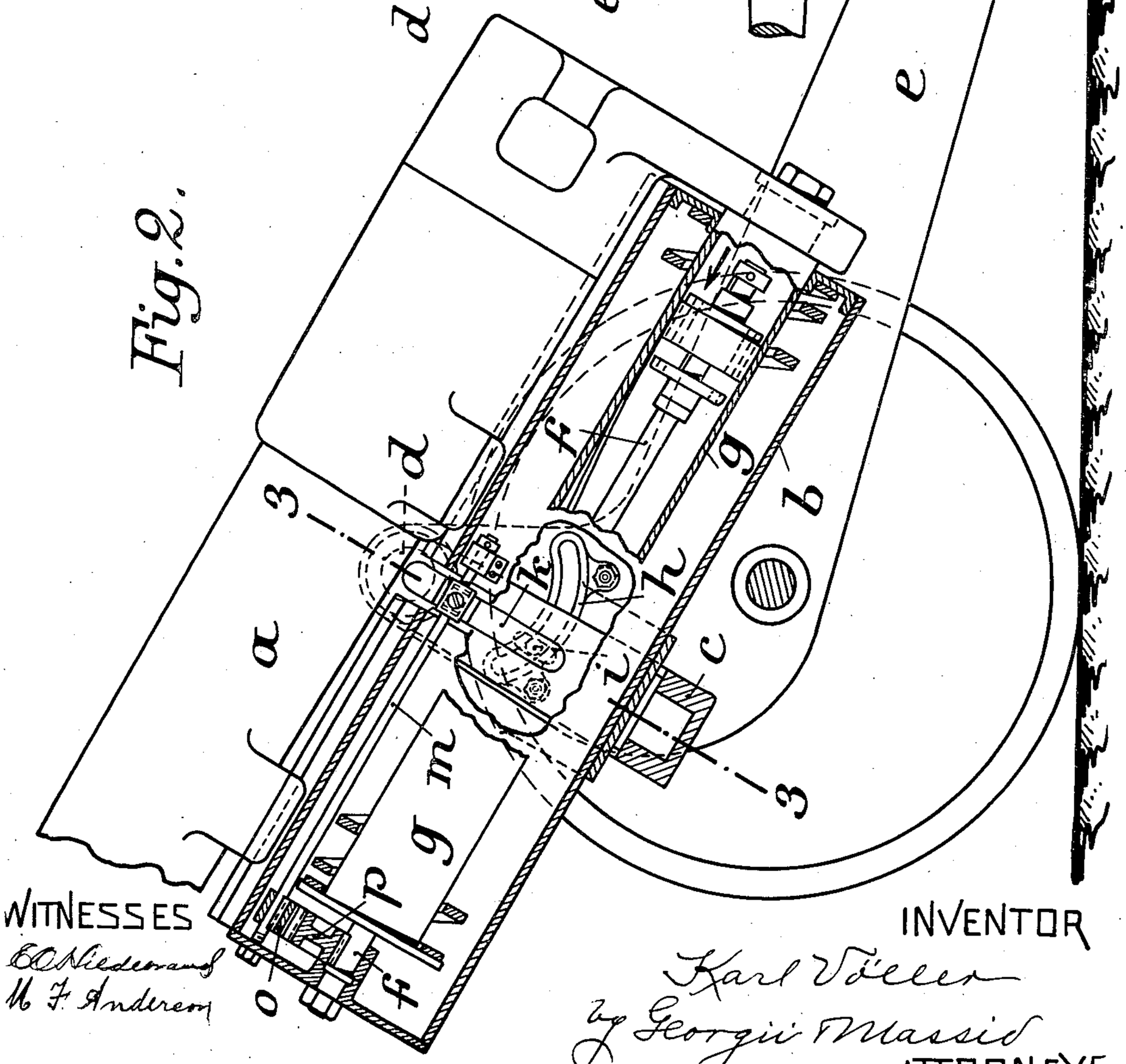


Fig. 2.



WITNESSES

E. C. Niederauer

H. F. Anderson

INVENTOR

Karl Völler

by Georgii Massid

ATTORNEYS

No. 818,801. PATENTED APR. 24, 1906.

K. VÖLLER.

AUTOMATIC BRAKE FOR TUBE RECOIL GUNS.

APPLICATION FILED APR. 7, 1904.

4 SHEETS—SHEET 3.

Fig. 5.

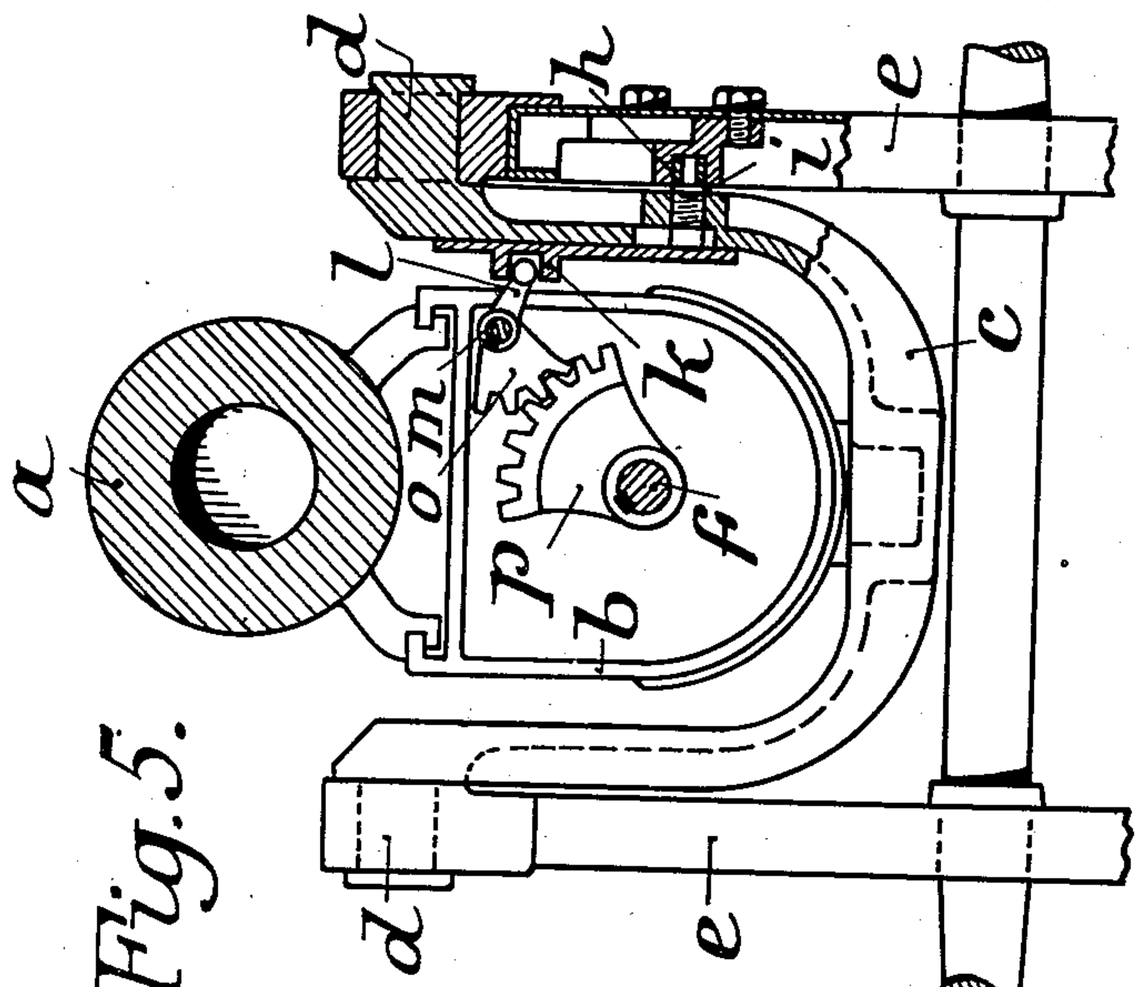
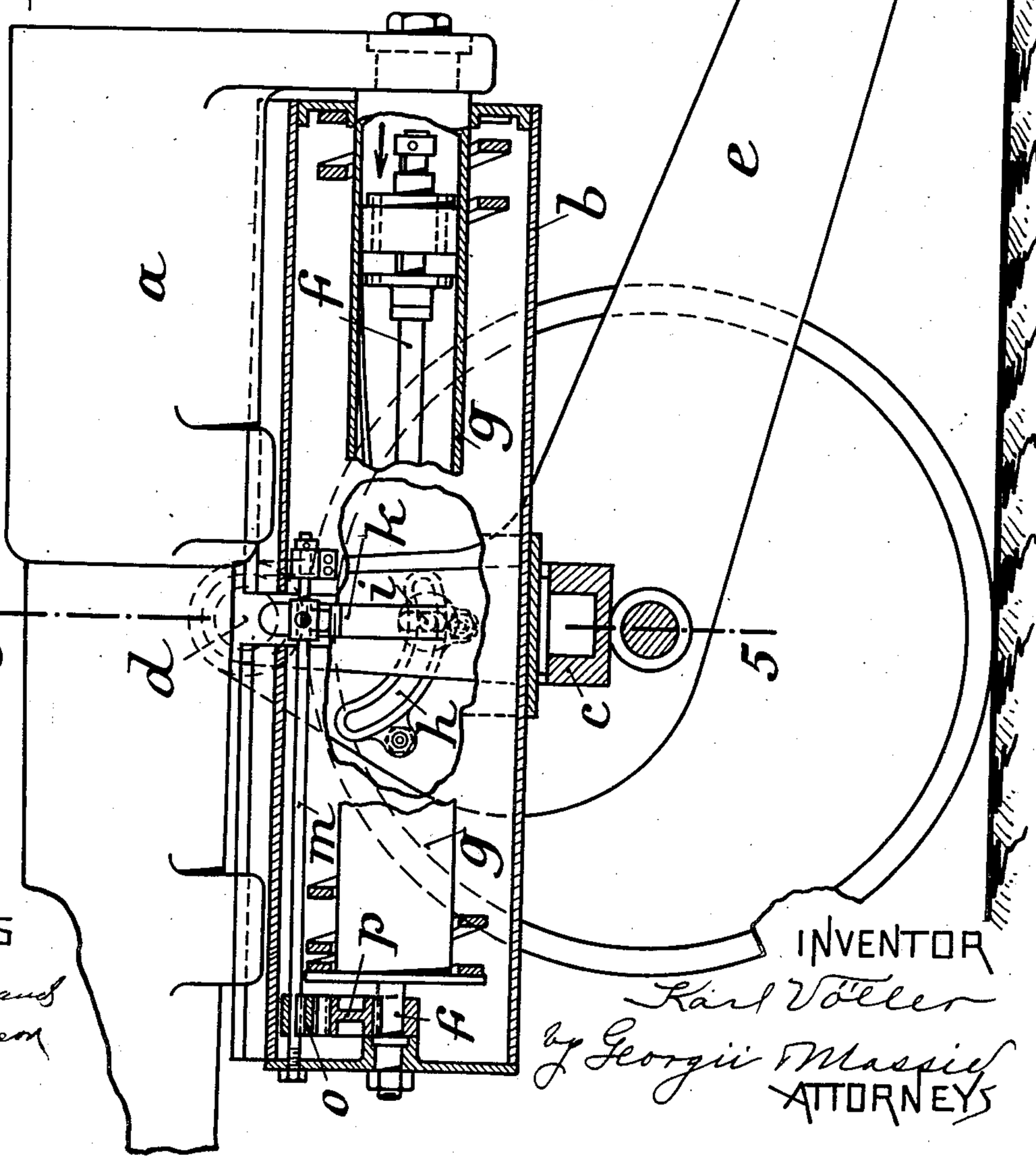


Fig. 4.



WITNESSES

E. A. Riedebrand

M. F. Anderson

INVENTOR

Karl Völler

by Georgii Massie

ATTORNEYS

No. 818,801. PATENTED APR. 24, 1906.

K. VÖLLER.

AUTOMATIC BRAKE FOR TUBE RECOIL GUNS.

APPLICATION FILED APR. 7, 1904.

4 SHEETS—SHEET 4.

Fig. 7.

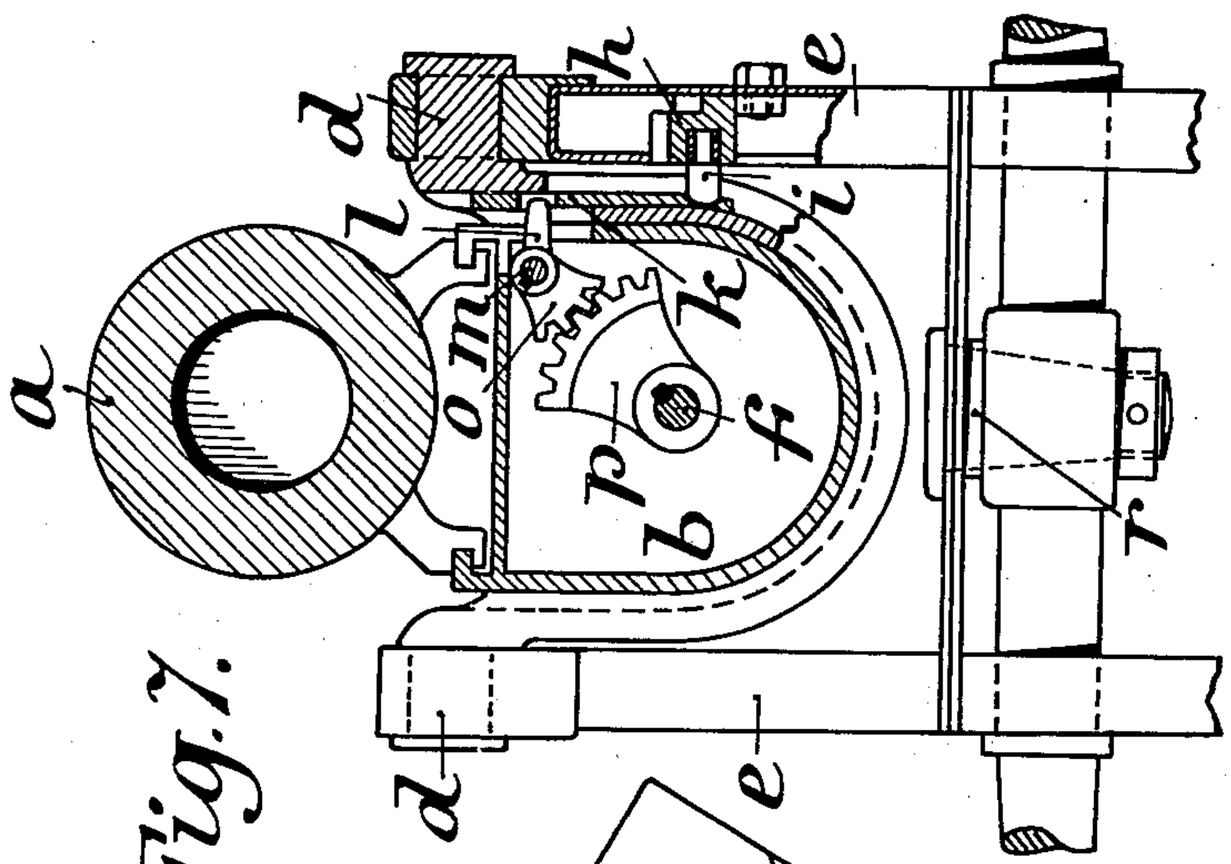
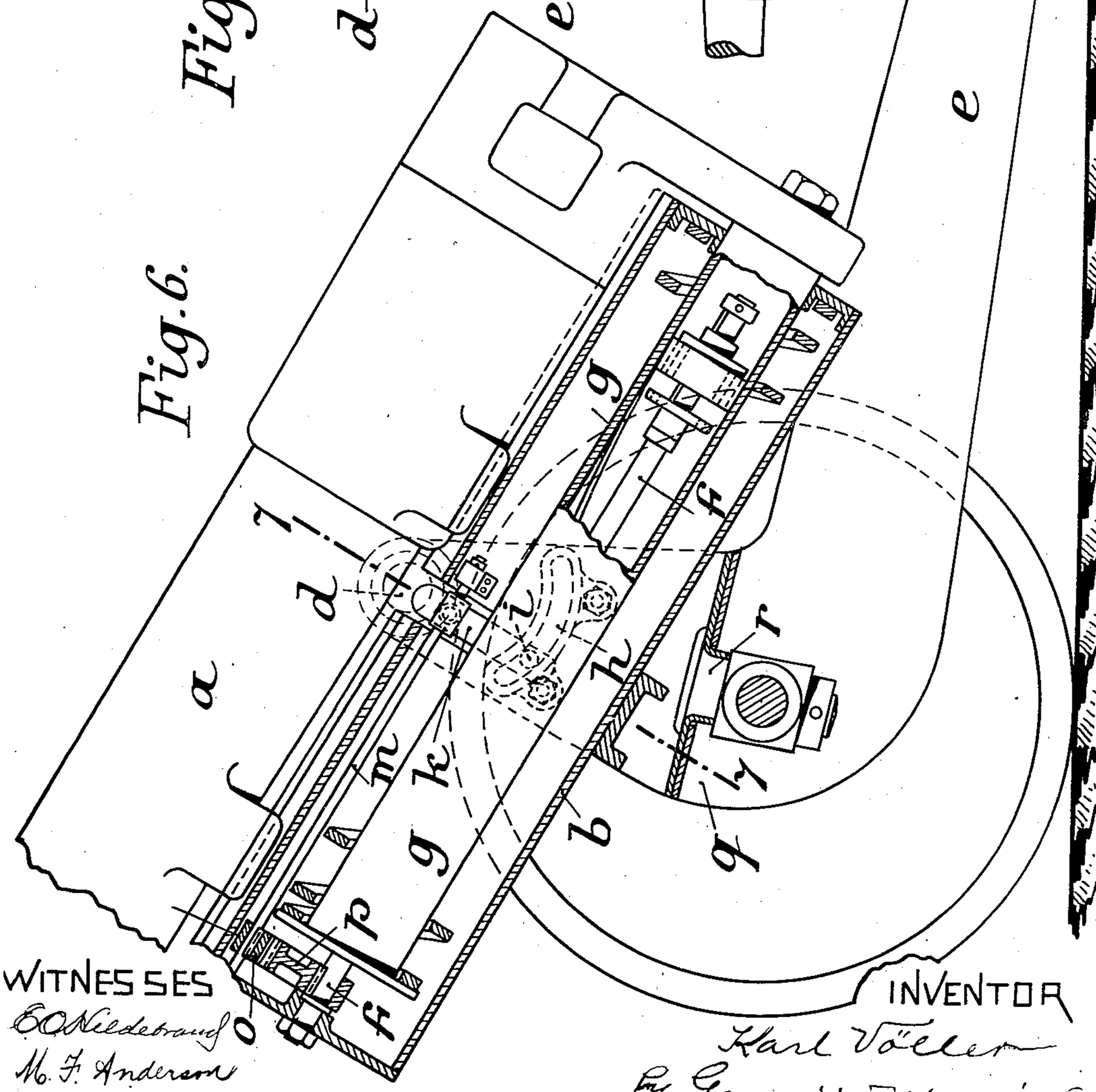


Fig. 6.



WITNESSES

E. A. Niedebrandt

M. F. Anderson

INVENTOR

Karl Völler

by Georgii Mauritz

ATTORNEYS

UNITED STATES PATENT OFFICE.

KARL VÖLLER, OF DÜSSELDORF, GERMANY, ASSIGNOR TO RHEINISCHE METALLWAREN-UND-MASCHINENFABRIK, OF DÜSSELDORF-DERENDORF, GERMANY.

AUTOMATIC BRAKE FOR TUBE RECOIL-GUNS.

No. 818,801. Specification of Letters Patent. Patented April 24, 1906.

Application filed April 7, 1904. Serial No. 202,042.

To all whom it may concern:

Be it known that I, KARL VÖLLER, engineer, a subject of the German Emperor, residing at 47 Zülicherstrasse, Düsseldorf, Germany, have invented certain new and useful improvements in devices for automatically changing the effect of the brake in tube recoil-guns having a hydraulic brake; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In guns having a recoil-tube which must shoot with a high elevation devices have been proposed for varying the resistance of the brake to correspond with the different elevations of the tube, and particularly to bring about a variation in the length of the recoil. In guns of this kind having hydraulic brakes the aforesaid effects are achieved, for example, by causing the piston-rod or the brake-cylinder to turn, and thus to change the position of the internal organs of the brake—for example, the position of a piston-valve.

There are provided devices whereby the rotation of the piston-rod or of the brake-cylinder necessary for varying the action of the brake or the length of recoil is effected by the act of elevating the gun.

If the upper carriage terminates near the shield or the trunnions, it is comparatively easy to derive the rotation of the piston-rod or of the brake-cylinder from the movement which elevates the tube by the intermediary of toothed wheels, worms, or the like and a toothed segment. In usually-constructed guns, however, in which the trunnions are approximately in the middle of the upper gun-carriage difficulties of construction present themselves. Moreover, derivation of the movement through toothed gearing has the disadvantage that the angle of rotation through which the piston-rod or the brake-cylinder is turned is always directly proportional to the angle through which the tube is turned by the act of elevation. It follows that the shortening of the length of recoil is also directly proportional to the angle of elevation. As a result of this the locus of the end points of the recoil forms an arc of a spiral, thus giving an unnecessarily short recoil for the gun in its position of maximum elevation, or if the recoil in this position be the maximum amount permitted by the clearance-space between the end of the gun and the ground then at other angles of elevation somewhat less than the maximum the recoil will be so great as to bring the gun in contact with the ground. Hence it is advantageous, and, in fact, necessary, to depart from the above-mentioned practice of making the decrease in length of recoil a regular function of the angle of elevation, and since such departure was impossible with prior devices I have produced the present invention to permit it to be done. Therefore the present invention relates to a construction by means of which in the act of elevating the gun the variation of the working of the brake can follow according to any desired law and not merely directly proportional to the angle of elevation. By the employment of such a construction the shortening of the length of recoil instead of being in a constant ratio to the angle of elevation of the gun may be in varying ratios to such angle of elevation—that is to say, the shortening of the recoil may have one ratio through a certain portion of the arc of elevation and a different ratio through some other portion of the arc of elevation, thereby attaining the very important advantage that the length of recoil of the gun for each angle of elevation may be predetermined not by what the recoil is at some other angle of elevation, but by the conditions to be met at that particular angle of elevation, such as the component of the weight of the gun to be resisted by the recoil device, the clearance between the end of the gun at its limit of recoil and the ground, and the extent to which the recoil of the gun can be transmitted to the ground.

In the accompanying drawings, Figure 1 is a diagrammatic side elevation of a tube recoil-gun in a horizontal and an inclined position wherein a curve is given for the end points of the recoil in the different positions which at one position suddenly changes its direction. Fig. 2 shows a gun constructed according to this invention in a position of elevation, the figure being a side elevation in section through the gun-carriage, a part of the brake-cylinder and of the piston-rod, as well as the wall of the upper gun-carriage, being broken away. Fig. 3 is a cross-section

on line 3 3 of Fig. 2. Fig. 4 shows the gun with its tube in a horizontal position, the parts being otherwise similar to those of Fig. 2. Fig. 5 is a cross-section on line 5 5 of Fig. 4. Fig. 6 is a part sectional elevation of a modification showing the tube in elevated position. Fig. 7 is a cross-section on line 7 7 of Fig. 6.

Referring to Fig. 1, it will be seen that the recoil of the tube shown by the dotted line *x x y* is shorter in the position of elevation than in the horizontal position. In the position of elevation shown in the figure the gun-tube and the brake-cylinder would be in contact with the ground if the recoil were not shortened, and in order to avoid this precautions must be taken.

The termination of the recoil in the position between the horizontal and the elevated position shown are along the curve *x*. If, however, the gun is at any time fired at a still greater elevation, the curve *x x* must not follow its former course, since in that case the gun-tube or the brake-cylinder would soon be in contact with the ground. It is essential, therefore, that from a certain position of elevation the shortening of the recoil must be more rapid than before, so that the part *x y* of the curve becomes approximately horizontal—that is to say, the ratio of the shortening of the recoil to the angle of elevation is different along the part *x y* of the curve from what it is along the part *x x*. For the purpose of accomplishing this result I provide means for shortening the length of the recoil in varying ratios to the angle of elevation, and this means is automatic in its action, so that it is only necessary to elevate the gun in the usual way to bring about the desired shortening of the length of the recoil in the appropriate ratio to the angle of elevation.

In the present example there is provided a cam device having an operative surface which is curved according to the curve to be formed by the locus of the limits of recoil at the different angles of elevation. This cam device is carried by an immovable part of the gun-carriage and its said operative surface is engaged by a part so fixed to the swinging part of the gun—such as, for instance, to the upper gun-carriage—that it receives when the gun-tube and the upper gun-carriage swing a movement in a plane which is vertical to the longitudinal extension of the upper gun-carriage by virtue of its engagement with the predetermined curve. This movement may then be translated through any desired means of translation into the necessary rotatory movement of the piston-rod or the brake-cylinder.

In the form shown in Fig. 2, *a* is the gun-tube, which slides on the upper gun-carriage in the known manner. The upper gun-carriage rests in a carrier *c*, in which it can move sidewise on a pivot. The carrier *c* is journaled in the lower gun-carriage *e* on the trunnions *d*. The gun-carriage *e* remains stationary when it is unlimbered, while the gun-tube, the upper gun-carriage, and the brake mechanism contained therein swing in the lower gun-carriage on the trunnions *d* whenever the angular position of the tube is to be moved from the horizontal.

In the upper gun-carriage is fixed the rotatory piston-rod *f*, which carries the piston-valve in the brake-cylinder *g*, firmly connected with the gun-tube. The opening of this valve-piston can be varied by the rotation of the piston-rod for the purpose of varying the length of recoil. The construction of this piston-valve is no part of the present invention.

On the side *e* of the gun-carriage there is fixed a cam device *h*, which in the present instance has a cam-groove. In this groove slides a pin *i*, which projects from a sliding piece or slide *k* into the groove. The slide *k* is slidably connected with a part, such as the tube-carrier *c*, which sharesthe swinging movement of the tube in a vertical plane. The front part of the middle line of the curved cam-groove *h* lies nearer to the axis of rotation of the trunnions *d* than the rear part does. If now the tube, together with the parts in connection with it, is brought from the horizontal position, Fig. 4, to the inclined position, Fig. 2, the pin *i*, together with the slide *k*, makes a relative movement upwardly and vertically to the upper gun-carriage in consequence of the engagement of the pin *i* in the curved cam-groove *h*, as will be seen from Figs. 5 and 3. In consequence of this the slide turns an arm *l* upward, which arm is mounted on a shaft *m*, carrying a toothed segment *o*. The latter engages with a toothed segment *p*, mounted on the piston-rod *f*. In this manner there is imparted to the piston-rod by the upward movement of the slide *k* a rotation the relation of which to the swinging of the gun-tube of the upper gun-carriage is determined by the curve of the cam device *h*.

The form shown in Figs. 6 and 7 is distinguished from that described above in that the tube-carrier *c* is fixed to the upper gun-carriage *b*. In this case the slide *k* may be directly united to the upper gun-carriage. The lateral turning movement is in this case rendered possible by making the upper part *q* of the under gun-carriage to rotate relatively to the bottom part on a pivot *r*. As in the case of the form shown in Figs. 2 to 5, in consequence of rotating the upper gun-carriage on the pivot in the tube-carrier *c* the longitudinal axis of the upper gun-carriage may at times form a small angle with the surface of the tube-carrier, which remains parallel to the longitudinal axis of the carriage, the separation of the shaft *m* from the slide *k* is

somewhat changed. This condition is allowed for by coupling the slide and the arm *l* together only in a vertical direction, while in a horizontal direction the movement in opposite directions is possible. In the form shown in Figs. 6 and 7 the variation of the separation between the shaft *m* and the slide *k* does not occur.

It is obvious, of course, that the slide *k* may be omitted and the cam device arranged to operate the arm *l* directly.

It will be noted that by employing a cam device for adjusting the means for varying the length of the recoil I provide an arbitrarily-acting mechanism for shortening the length of recoil of the recoil device, for the reason that a cam device can be constructed with any desired configuration of operating-face, thus enabling it to act arbitrarily, or, in other words, without regard to any mathematical law of proportion in varying the adjustment of the recoil device.

Having thus fully described my invention, what I claim is—

1. The combination, with a gun mounted for movement through different angles of elevation, and a device for regulating the recoil of the gun, of means actuated by the angular movement of the gun and arranged to shorten the recoil in varying ratio to the angular movement of the gun.

2. The combination, with a gun mounted for movement through different angles of elevation, and a device for regulating the recoil of the gun, of a variable-movement transmission device arranged to transmit the angular movement of the gun in varying ratio to the recoil-regulating device, whereby the recoil of the gun is varied otherwise than directly proportional to the change in the angle of elevation of the gun.

3. The combination, with a gun-carriage and a gun mounted thereon and adjustable to different angles of elevation, of a recoil device arranged to check the recoil of the gun, means for shortening the length of recoil of the recoil device, and a cam device having a curved operative surface arranged to adjust said means.

4. The combination, with a gun-carriage and a gun mounted thereon and adjustable to different angles of elevation, of a recoil device arranged to check the recoil of the gun, a cam device having a curved operative surface and means for shortening the length of recoil of the recoil device, said means being movable with relation to and arranged to be adjusted by the cam device.

In testimony whereof I have affixed my signature to this specification in the presence of two witnesses.

KARL VÖLLER.

Witnesses:
PETER LIEBER,
EMMA HERBER.